Document of
The World Bank
FOR OFFICIAL USE ONLY

Report No: 42850-CN

CHINA: LUOJING COREX PROJECT

CARBON FINANCE ASSESSMENT MEMORANDUM

FOR A

SPANISH CARBON FUND EMISSION REDUCTION PURCHASE AGREEMENT

IN THE AMOUNT OF APPROXIMATELY US$45 MILLION

WITH

BAOSTEEL GROUP PUDONG IRON & STEEL CO., LTD.

June 9, 2008

Rural Development, Natural Resources and Environment Sector Unit
Sustainable Development Department
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective June 9, 2008)

Currency Unit	=	Renminbi (RMB)
RMB 6.92	=	US$1
US$0.14	=	RMB 1

FISCAL YEAR

January 1	–	December 31

ABBREVIATIONS AND ACRONYMS

Baosteel	Baosteel Group Corporation
BF	Blast Furnace
BFG	Blast Furnace Gas
BP	Bank Policy
CCPP	Combined Cycle Power Plant
CDM	Clean Development Mechanism
CDMF	Clean Development Mechanism Fund
CER	Certified Emission Reduction
CFAM	Carbon Finance Assessment Memorandum
CFO	Carbon Finance Operation
CN^-	Cyanide ion
CO_2	Carbon dioxide
COD	Chemical Oxygen Demand
COREX	Coal Reduction Extreme
CPF	Carbon Partnership Facility
CPS	Country Partnership Strategy
Cr	Chromium
Cr^{6+}	Chromium ion
dB	Decibel
DOE	Designated Operational Entity
EAP	East Asia and Pacific
EB	Executive Board
EBITDA	Earnings Before Interest, Taxes, and Depreciation
ECPG	East China Power Grid
EHSG	Environmental, Health, and Safety Guidelines
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
F	Fluoride
Fe	Iron
ERPA	Emission Reduction Purchase Agreement
GDP	Gross Domestic Product
GHG	Greenhouse gas
GoC	Government of China

ha	Hectare
IRR	Internal Rate of Return
ISO	International Standards Organization
kJ/m^3	Kilojoule per cubic meter
km^2	Square kilometer
kWh	Kilowatt hour
Leq (A)	Continuous equivalent sound level
m	Meter
m^2	Square meters
m^3	Cubic meters
mg/Nm^3	Milligram per normal cubic meter
Mn	Manganese
MPa	Mega Pascal
MW	Megawatt
Ni	Nickel
NDRC	National Development and Reform Commission
NH_4^+-N	Ammonium ion nitrogen
Nm^3	Normal cubic meter
NO_2	Nitrogen dioxide
NOx	Nitrogen oxides
NRCR	National Research Center for Resettlement
OHSAS	Occupational Health and Safety Advisory Services
OP	Operational Policy
PAPs	Project Affected Persons
PCM	Project Concept Memo
PDD	Project Design Document
PER	Post-Evaluation of Resettlement
pH	Measure of the acidity or alkalinity of a solution
PM_{10}	Particulate matter of 10 micrometers or less
Pusteel	Baosteel Group Pudong Iron and Steel Co. Ltd.
RMB	Renminbi (Chinese yuan)
SCF	Spanish Carbon Fund
SEPA	State Environmental Protection Administration
SO_2	Sulfur dioxide
SS	Suspended solid
tCO_2e	Tons of carbon dioxide equivalent
TSP	Total Suspended Particulate
UNFCCC	United Nations Framework Convention on Climate Change
VAI	Voest-Alpine Industries, Inc.

Vice President:	James W. Adams, EAPVP
Country Director:	David Dollar, EACCF
Sector Director:	Christian Delvoie, EASSD
Sector Manager:	Rahul Raturi, EASRE
Task Team Leader:	Hiroshi Ono, EASRE

CHINA

Luojing COREX Project

CONTENTS

CHINA

LUOJING COREX PROJECT

CARBON FINANCE ASSESSMENT MEMORANDUM

EAST ASIA AND PACIFIC

EASRE

Date: June 9, 2008	Team Leader: Hiroshi Ono
Country Director: David Dollar	Sectors: Iron and steel industry
Sector Manager/Director: Rahul Raturi/Christian Delvoie	Themes: Climate Change
Project ID: P105575	Environmental screening category: B
Lending Instrument: Carbon Finance	

Project Financing Data

[ ] Loan [ ] Credit [ ] Grant [ ] Guarantee [X] Other:

For Loans/Credits/Others:
Total Bank financing (US$m.): 45
Proposed terms: In negotiated prices designated in Euro per ton of Certified Emission Reductions (CERs), paid annually

Financing Plan (US$m)

Source	Local	Foreign	Total
Borrower	2,000		2,000
IBRD/IDA			
Spanish Carbon Fund		45	45
Total:	2,000	45	2,045

Borrower:
N/A. The World Bank, as trustee for the Spanish Carbon Fund, will sign the Emission Reduction Purchase Agreement with Baosteel Group Pudong Iron & Steel Co. Ltd.

Responsible Agency: N/A

Estimated disbursements (Bank FY/US$m)

FY	2008	2009	2010	2011	2012	2013	2014		
Annual	n/a	n/a	n/a	n/a	n/a	n/a	n/a		
Cumulative	n/a	n/a	n/a	n/a	n/a	n/a	45		

Project implementation period: 7 years for CERs purchase
Expected starting date for CERs purchase: November 1, 2008
Expected ending date for CERs purchase: December 31, 2014

Does the project depart from the CAS in content or other significant respects? [ ]Yes [X] No

Does the project require any exceptions from Bank policies?	[ ]Yes [X] No
Have these been approved by Bank management?	N/A
Is approval for any policy exception sought from the Board?	N/A
Does the project include any critical risks rated "substantial" or "high"?	[ ]Yes [X] No
Does the project meet the Regional criteria for readiness for implementation?	[X]Yes [ ] No

Project development objective:

The development objective of the project is to reduce CO_2 emissions by displacing electricity consumption at a large iron and steel company compared with the baseline scenario – blast furnace, power generation, and purchase of deficient coal-fired electricity from the grid - by introducing the energy efficient COREX technology and combined cycle power plants (CCPPs) with the leverage of a Carbon Finance transaction.

Project description:

Component A: The construction and operation of a COREX plant and a CCPP in each of the two phases and subsequent electricity generation that will result in CERs.

Component B: A Carbon Finance transaction that will facilitate the purchase of the CERs.

Which safeguard policies are triggered, if any?
Environmental Assessment Policy (OP/BP 4.01)

Significant, non-standard conditions, **if any**, for: N/A
Board presentation: N/A

Loan/credit effectiveness: N/A

Covenants applicable to project implementation:

1. Approval of the proposed COREX methodology and registration of the project with the CDM Executive Board.
2. Annual certification of Emission Reductions, and the implementation of Environmental Management Plan.

I. STRATEGIC CONTEXT AND RATIONALE

A. Country and sector issues

1. With a rapidly growing coal-dependent economy, China has a critical role to play in global efforts to address climate change. China is already the second largest emitter of carbon dioxide (CO_2) in the world, and it could surpass the U.S., the current largest emitter, by the end of this decade.[1] The Government of China (GoC) has made commendable efforts to reform the energy sector and support the adoption of energy-efficient and renewable energy technologies. In the 11th Five-Year Plan (2006-2010), the GoC has pledged to improve energy efficiency per unit of gross domestic product (GDP) by 20 percent. On June 4, 2007, the GoC launched the National Climate Change Program to strengthen its commitment to combating climate change. The 20 percent improvement in energy efficiency by 2010, and subsequent reduction of CO_2 emissions, is one of the key measures to control greenhouse gas (GHG) emissions in the Program.

2. Energy consumption in the Chinese iron and steel industry is currently two and a half times greater than in 1980, and the sector now accounts for more than 10 percent of total energy consumption in China. Since energy consumption per ton of crude steel produced in China is about 20 percent greater than that of Japan, there is considerable potential for this sector to contribute to the overall reduction of CO_2 emissions at the national level.[2]

3. As part of the country's growing response to climate change, China ratified the Kyoto Protocol under the United Nations Framework Convention on Climate Change (UNFCCC) in August 2002. The Kyoto Protocol entered into force on February 16, 2005, committing Annex I (industrialized) countries to reduce their collective GHG emissions by about 5 percent below their 1990 levels on average during the period from 2008-2012. In fulfilling these commitments, the Annex I countries can achieve some of their emission reductions through several means including the Clean Development Mechanism (CDM) which provides a financial incentive to companies or entities in Non-Annex I (developing) countries to undertake projects that lead to reductions of GHG emissions. Certified emission reductions (CERs) from these activities can then be transferred to other entities or governments in Annex I countries at a price.

4. The GoC has agreed to collaborate with the Bank in the emerging market for CERs under the CDM. In October 2005, *Measures for Operation and Management of CDM Projects in China* were put into effect to regulate project development and identify national priorities, which include energy efficiency improvements, development and utilization of new and renewable energy, and methane recovery and utilization. The GoC also established a Clean Development Mechanism Fund (CDMF) to support the country's activities on climate change based on the National Climate Change Program.[3] A percentage of CER revenues from CDM projects in China will be transferred to build this CDMF. As such, China is well prepared to strengthen its participation in CDM activities.

[1] Source: WRI http://earthtrends.wri.org/updates/node/110
[2] Tokyo Energy Efficiency Group (2006). China Energy Efficiency Financing Project.
[3] The CDMF collects a percentage of all carbon credit transaction income, donations from international financial organizations, and other sources approved by the State Council. In the case of energy efficiency CDM projects in the iron and steel sector, two percent of carbon credit revenues are directed to the CDMF.

B. Rationale for Bank Involvement and Contribution to Sustainable Development

5. The Bank manages ten Carbon Funds, including the Spanish Carbon Fund (SCF) that was created in 2004. This fund was established to purchase GHG emission reductions from projects developed under the Kyoto Protocol to mitigate climate change while promoting the use of cleaner technologies and sustainable development in developing countries. Unlike other Bank development products, the Carbon Funds do not lend or grant resources to projects but rather contract to purchase CERs similar to a commercial transaction, paying for them annually or periodically once they have been verified by a third party auditor. As a result, these Carbon Finance transactions have provided an additional revenue stream that reduces financial risks and provides a means of leveraging new private and public investment into projects that reduce GHG emissions.

6. This Carbon Finance project is fully consistent with Pillar 3 of the Bank's Country Partnership Strategy (CPS) for China (2006-2010) which aims to manage resource scarcity and environmental challenges. In the CPS, Carbon Finance transactions are identified as a World Bank Group intervention for stabilizing GHG emissions, as well as part of the institution's support of China's commitment to protect the global environmental commons. In line with the catalytic function played by the Bank in the development of the carbon market thus far, and with a view toward developing and testing new approaches that can help address these important constraints, two carbon finance instruments were approved by the Bank in September 2007, namely: the Carbon Partnership Facility (CPF) and the Forest Carbon Partnership Facility**.** This Carbon Finance Operation (CFO), as well as the others in the iron and steel sector in China, offers an important opportunity for the Bank to foster larger, programmatic activities to scale-up the use of technologies that can reduce GHG emissions, promote sustainable development, and serve as a model for the development of new sector-wide carbon mitigation operations.

7. Energy efficiency is one of the national priorities of China for CDM development. In this domain, iron and steel sector projects offer significant CDM opportunities both in terms of the number and the volume of CERs. Given the strategic importance and potential for carbon transactions in the iron and steel sector, the Bank is now implementing or preparing several CFOs, such as the Nanjing Iron and Steel Converter Gas Recovery Project (P088106), Baotou Steel Industry Energy Efficiency Project (P102568), Meishan Coke Dry Quenching Project (P104601), and Shanghai Baosteel Energy Efficiency Bundle CDM Project (P108113), in addition to this CFO. Moreover, as the Bank moves to a more strategic focus on CDM activities, development of three individual projects including this CFO with Baosteel Group Corporation (Baosteel) has provided an opportunity for the Bank to develop a partnership with Baosteel, the parent company of the project sponsor to use Carbon Finance as an additional incentive and resource to expand its group-wide efforts on energy efficiency improvements. The Bank's Carbon Finance Unit has signed a Memorandum of Understanding with Baosteel that will engage the group in sharing its energy management experience with the Bank for the promotion of energy efficiency in the iron and steel sector both in China and abroad.

8. With these experiences and commitment to developing Carbon Finance transactions in China, including the current process of strategic engagement in the iron and steel sector, the Bank is well positioned to facilitate the transaction of CERs from this CFO.

9. The higher-level objectives of the CFO are to support China's continued efforts to address climate change, which is identified as a medium-term CPS goal, and ultimately to

contribute to China's sustainable development. This CFO contributes to these objectives by increasing energy efficiency in the iron and steel sector as well as by providing opportunities to reduce air pollutants.

II. CARBON FINANCE OPERATION

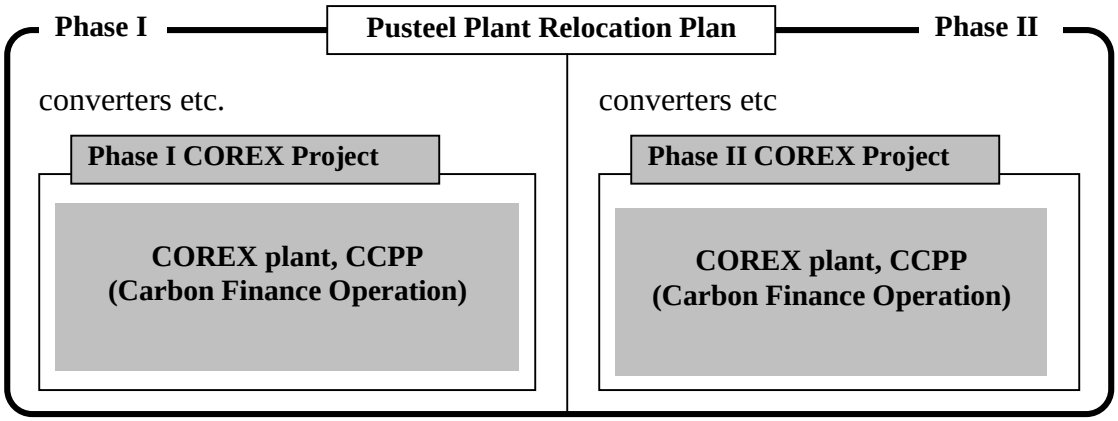
A. Background

10. The project sponsor is the Baosteel Group Pudong Iron and Steel Co. Ltd. (Pusteel). Pusteel was established in 1913 and became a subsidiary of Baosteel in 1998. Baosteel is a state-owned company that became China's largest iron and steel conglomerate after a series of mergers in November 1998. At the peak of its operations, Pusteel produced 2.2 million tons of steel and had about 20,000 employees. In 2006, prior to its relocation of operations away from its original site in Pudong, Pusteel had approximately 4, 400 full time staff, produced 2.1 million tons of annual rolled strip, US$1,392 million in total capital and US$11 million annual net profit.

11. Pusteel was located in the Pudong district of Shanghai from 1913 until late 2007. The original plant site occupied 40 percent of the planned area for the up-coming 2010 Shanghai World Exposition and, as a result, the entire plant has been in the process of relocation since June 2005. Pusteel's new location is on a 3.2 square kilometer site in Luojing town, Baoshan District in northern Shanghai. Pusteel's heavy plate plant at the Pudong site ceased operations in October 2007 and the land was sold to the Shanghai World Expo Land Holding Co. Ltd.

12. The Plant Relocation Plan will be completed in two phases. In Phase I, a COREX plant and other steel-making facilities were built at the Luojing site which has molten iron production capacity of 1.5 million tons per year. The test operation of Phase I commenced on November 8, 2007 and commercial production is to begin in the spring of 2008. In Phase II, another COREX plant with the same scale is planned to be constructed at the same site so that the production capacity will double. The Phase II Plan is expected to become operational in the first quarter of 2010. This CFO is based on the emission reductions to be achieved through the installation and operation of the COREX plants in Phase I and II, together with their associated combined cycle power plants (CCPPs). The other components of the Plant Relocation Plan, such as converters and casting and rolling mills, are not included in the CFO as they do not directly result in the reduction of GHG emissions (see Figure 1).

Figure 1: Plant Relocation Plan and COREX Carbon Finance Project



B. Description of the Carbon and Finance Operation

13. The development objective is to reduce CO_2 emissions by displacing electricity consumption at a large iron and steel company compared with the baseline scenario – blast furnace (BF), power generation and purchase of deficient electricity from the grid - by introducing the energy-efficient COREX technology and CCPPs with the leverage of a Carbon Finance transaction. The CFO will contribute to enhancing sustainable development opportunities by mitigating global climate change and promoting the expanded use of energy efficiency technologies that also reduce local air pollution associated with the operation of BFs.

14. The CFO consists of two components:

Component A: The construction and operation of a COREX plant and a CCPP in each of the two phases and subsequent electricity generation that will result in CERs.

Component B: A Carbon Finance transaction that will facilitate the purchase of the CERs.

15. Construction and Operation of COREX Plants: Component A addresses the construction of a COREX plant and a CCPP in each phase. The main components of a COREX plant include a reduction shaft furnace, gasifier, dust collection system, and ore and coal feeding system. Each COREX plant has a molten iron production capacity of 1.5 million tons per year. Two oxygen stations with the capacity of 60,000 Nm^3/hour will also be installed for each COREX plant to provide oxygen used at the plant. The total electricity generation capacity for each phase will be 169.45 MW resulting in annual electricity production of 1.26 billion kWh. The generated electricity will displace electricity supplied through the East China Power Grid (ECPG) that is produced from coal-fired power plants that release large amounts of GHGs.

16. The CERs will be achieved through the installation of COREX plants and CCPPs instead of conventional BFs. COREX is a smelting-reduction process developed by the Austria-based Voest-Alpine Industries, Inc. (VAI) that produces hot metal of BF quality that is suitable for all steel applications. The COREX process mainly differs from the conventional BF in that non-coking coal is directly used as the reducing agent and energy source and iron ore can be directly charged to the process in the form of lump ore and/or pellets. Compared with the BF technology, COREX improves reduction efficiency through the direct reduction process, thus it lowers energy consumption and reduces CO_2 emissions. In addition, by-product gas will be used for electricity generation in CCPPs, which provides additional CO_2 reduction opportunities. A detailed technical description of these activities is included in Annex 1 and a description of how the subsequent emission reductions are achieved is included in the Project Design Document (PDD) attached to the Carbon Finance Assessment Memorandum (CFAM) package.

17. To date, four COREX plants have been installed and are operational including one each in South Korea and South Africa and two units at a site in India where coal suitable for COREX is available at a low price. The Luojing COREX plants will be the fifth and sixth such installations, as well as the largest COREX plants in the world, as they will employ the new COREX C-3000 technology instead of COREX C-2000 technology installed at the four existing plants. The introduction of COREX is a significant technological advance for the Chinese iron and steel sector while there are a number of challenges and risks. The CCPP technology also involves considerable technology risks since only a very limited number of CCPPs are operational in the Chinese iron and steel sector.

18. Carbon Finance Transaction: The CDM enables the creation, issuance, and sale of CERs from projects undertaken in developing countries that reduce emissions of GHGs. This CFO will facilitate the transaction of the CERs between Pusteel and the Bank-managed SCF, the terms and conditions of which will be agreed in the Emission Reduction Purchase Agreement (ERPA) to be signed by the two parties. The purchase will be a performance-based contract under which payments are triggered by successful verification of the reduction of GHG emissions by an accredited independent auditor, or Designated Operational Entity (DOE)[4], under CDM rules. The quantity of CERs to be contracted, the length of time over which the purchase will be made, and the price to be paid will be agreed between the Bank and Pusteel before ERPA signature. In addition, as part of its responsibilities, the SCF will ensure registration of the project with the CDM Executive Board (EB).

C. Performance Indicators

19. The primary project performance indicator will be the annual amount of CERs delivered, measured in tons of CO_2 equivalent (tCO_2e), which will be calculated as the difference between the amounts of CO_2 emissions that would be produced from the CFO and that would have been produced from the baseline BF process.

D. Alternatives Considered and Reasons for Rejection

20. There are two feasible technical options for the iron-making process, BF and COREX. Also there is an option either to install or not install power plants using by-product gas produced from the BF or COREX process. Within these options, three technically feasible options were examined and justifications for adoption or rejection are summarized below.

(a) ***Option 1: BF without power plant***. The company continues to use the conventional BF process and purchase electricity from the grid.

(b) ***Option 2: BF with power plant***. The company continues to use the conventional BF process, but installs power plants to partly displace electricity demand from the grid.

(c) ***Option 3: COREX with CCPP***. Instead of using the conventional BF technology, the company uses the COREX technology, the only viable alternative iron-making technology that has proven track record at industrial scale, and also installs CCPPs.

21. Constructing and operating a BF is the most financially attractive option normally applied in the Chinese iron and steel sector. The BF process produces a large volume of blast furnace gas (BFG), which is a valuable secondary energy source. It is a common practice for iron and steel companies to use BFG to meet the heating demand of steel production processes. When excess BFG remains after fulfilling the process heat demands, some iron and steel companies install generators to use the excess BFG for power generation. However, these options were rejected because Pusteel judged that Option 1 and 2 were less attractive taking into account various factors mentioned immediately below. As the CDM requires a more conservative

[4] All DOEs have to be accredited by the CDM EB, and have either of three functions: 1) to validate and subsequently request registration of a proposed CDM project activity; and 2) to verify preparation of a registered CDM project, or 3) to certify the amount of emission reductions generated and to request the EB to issue CERs.

estimate of the baseline emissions, Option 2, which is more energy efficient and involves fewer GHG emissions than Option 1, is chosen as the baseline scenario.

22. Option 3 is less financially attractive and incurs higher technical risks compared to Options 1 and 2. However, Pusteel has chosen this option because of: (a) the wider applicability of various quality coals for the iron-making processes; (b) local environmental benefits, including the elimination of emissions from sinter and coking processes; (c) enhancement of technical competence and diversity that provides the company with a long-term competitive edge; and (c) maximization of energy savings and revenues generated from the sale of CERs. Overall, Pusteel judged that Option 3 offers the best opportunity for achieving project development objectives, meeting its social responsibility, and enhancing sustainable development benefits.

E. Financial Aspects

23. The Bank is not financing the construction or operation of any part of the activities that will generate CERs. The project sponsor plans to finance the project with a mix of debt and equity. Financial analysis was conducted to (a) evaluate Baosteel based on its financial statements and (b) assess the financial viability of the CFO.

24. **Due Diligence of the Project Sponsor:** Financial due diligence focused on the parent company, Baosteel, rather than on Pusteel as the latter's product line has changed entirely in the past three years of the scale-down of operations in Pudong. The decisions to relocate Pusteel and to invest in COREX technology were all made at the corporate level, and it is Baosteel that is assuming responsibility for the success of the new plant.

25. Baosteel was established in 1998 and is the largest steel company in China, with an annual production capacity of 30 million tons in 2007. The company has experienced impressive gains in production in recent years through a series of mergers and upgrades of facilities, from 7.11 million tons of crude steel in 2000 to 11.87 million in 2004 and to 21.74 million tons in 2006. The company has posted gains in terms of sales, net profits, and earnings before interest, taxes, and depreciation (EBITDA) from 2004-2006, and in 2005 the company ranked number 296 on Fortune Magazine's Global 500 list. In December 2006, the company's credit rating was up-graded by Standard and Poor's from BBB+ to A- and is one of only two steel companies in the world to achieve such a high rating. Baosteel has operated steadily during the three year period (2004-6) and its above-average credit rating for the iron and steel sector indicates that the operations of the company are stable and not a significant indicator to monitor. See Annex 2 for more details.

26. **Project Costs:** The initial investment for the COREX, CCPP, and oxygen station is 40 percent higher than that of a conventional BF plant with comparable hot metal production capacity (including coking and sintering facilities) in China. Pusteel estimates that the production cost per ton of hot metal is about 20 percent higher than that from BF applications, which might be partially compensated by revenues from CERs. Nevertheless, Pusteel judged that the benefits of environmental protection and enhanced technology competence and diversity combined with carbon revenues outweighed the higher investment and operational costs of COREX. More detailed project cost analysis using a relative scale for comparison (due to confidentiality reasons) is included in the PDD which is attached to the CFAM package.

27. **Project Financing Plan:** The total Plant Relocation Plan will cost RMB 14 billion and includes the cost of the COREX, CCPP, and oxygen station investments that comprise the CFO. The financing plan for the relocation is composed of 60 percent equity and 40 percent debt. Most of the equity comes from relocation compensation provided by the Shanghai World Expo Land Holding Co., Ltd.

F. Technical Aspects

28. While COREX is a relatively new technology, available records indicate stable and successful operation at the four existing plants in South Korea, South Africa and India. Though COREX can enjoy wider applicability of various quality coals, it also has specific requirements on feed-in coal in terms of size, shape, and density. A challenge for the CFO is that a similar type of feed-in coal, which has been successfully applied in those countries, is difficult to obtain domestically in China. To avoid huge costs from relying on imported coal, Pusteel will use mixed coals all produced in China. In additional, the CFO is the first COREX plant in China, therefore, there is the potential for significant technical risks.

29. For the successful construction and operation of the CFO, Pusteel has established a close cooperation with the technology provider VAI and two companies in India and South Africa that are operating COREX plants. The new COREX facilities were designed based on the expertise of VAI and the Baosteel Iron & Steel Design Institute, which has been engaged in the study of the COREX technology for nearly 30 years, and experiences learned from the existing plants. The main issues and risks from the previous COREX operations were fully considered and mitigation measures are summarized in Table 1.

Table 1: Technical Issues/Risks and Mitigation Measures

Risks/Issues	Measures
Adoption of new COREX C-3000 technology instead of COREX C-2000 technology employed in the four existing plants	COREX C-3000, having nearly double the production capacity when compared with C-2000, was developed based on the mature experience of C-2000. VAI guarantees the success of this up-scaling.
Compatibility of raw material	Raw materials (coal and ore) will strictly follow the requirements of VAI during the first six months of operation to ensure successful start-up. An extensive study on alternative raw materials has been conducted by Baosteel, and a raw material optimization plan has been developed.
Cost-effectiveness of maintenance	More than 90 percent of equipment will be procured from domestic sources to ensure timely and cost-effective repair and maintenance. This is achieved through plant design by the local partner of VAI.
Durability of refractory material and furnace	A cycling-water cooling system installed inside the furnace wall is employed replacing a water-spraying cooling system installed on the outside wall in the case of C-1000, which will ensure an even and effective cooling effect and enhanced durability of the refractory material and furnace.
Fluctuation of gas flow affecting the stability of power generation	A 300,000 m^3 gas storage tank is designed to stabilize gas flow rate for power generation. The gas system is also connected with that of nearby Baosteel plants to receive or distribute gas for power generation.

Operational capacity of plant workers	A total of 60 key team leaders from operational worker teams completed 12 weeks of on-the-job operation and maintenance training at the COREX plants in India and South Africa. Two rounds of domestic training were provided for about 300 workers who will work at the new COREX facilities. Most of them have extensive experience in operating large BF plants for Baosteel. Hands-on trainings will be provided by VAI during the commissioning period, and technical guidance afterward.
In-house knowledge development and accumulation	Pusteel has organized various training courses for COREX plant workers to familiarize them with a VAI Operation Manual, as well as practice procedures obtained from Saldanha Plant (South Africa). Pusteel is developing a "500 Questions about COREX" to be used as an education material for all staff. Pusteel has established several special technical research groups to examine key technical issues on COREX and, as a result, a comprehensive trial operation plan has been developed. Pusteel has also conducted several studies aimed at strengthening the competitiveness of C-3000 technology, such as the utilization of fine coal, coal/ore composition, caking of furnace, and life of furnace. The following guidelines and standards have been developed by Pusteel: - Technical Guidelines - Safety Guidelines - Working Post Guidelines - Equipment Spot Inspection Standards - Technical Standards for Maintenance - Practice Standards for Maintenance

G. Institutional Aspects

30. **National Approvals:** The National Development and Reform Commission (NDRC) approved the Phase I Plan in June 2005 and the Phase II Plan in November 2007. The State Environmental Protection Administration (SEPA) approved the Environmental Impact Assessment (EIA) Report for the Plant Relocation Plan in March 2005.

31. **COREX CDM Methodology:** Since none of the currently-approved CDM methodologies could be directly applied to the COREX technology, a new CDM methodology has been developed in close cooperation with Baosteel and a technical consulting firm based in China. The proposed methodology builds on the GHG inventory developed by the International Iron and Steel Association and the database management system developed in-house by Baosteel. The new methodology was first submitted to the Methodology Panel under the CDM EB in February 2008. In response to the result of pre-assessment, necessary revisions were made and the revised methodology was submitted to the Methodology Panel in April 2008, which is attached as part of the CFAM package.

32. The Methodology Panel is expected to review the proposed new methodology in September 2008 and subsequently to share its recommendations regarding approval or request for improvement. CDM methodologies are based on three broad principles of traceability, measurability, and quantification of GHG emission reductions. To achieve this, the proposed methodology includes a detailed monitoring and data management system. Upon approval by the Methodology Panel, the methodology will be forwarded to the CDM EB for its approval. Once the methodology is approved by the CDM EB, the Secretariat will issue the methodology as per standard CDM format and the project can proceed with final validation and registration.

33. **Registration and Certification:** In accordance with the rules and procedures for CDM projects, project proponents must collect and archive all relevant data necessary for calculating emission reductions from a CDM project activity in accordance with the Monitoring Plan included in the PDD. The Monitoring Plan, established under the ERPA, provides the methodology and tools for measuring and calculating CERs generated by the project.

34. **Institutional Arrangements at Corporate Level:** The construction of the Phase I COREX plant and CCPP was completed in October 2007 and they are now undergoing test operations. The Iron-Making Department of Pusteel is responsible for the operation and maintenance of the COREX plant, with the support of VAI. The Baosteel Iron & Steel Design Institute will provide full technical support as the pioneer of COREX research in China. The Environmental Protection and Resource Utilization Department of Baosteel will act as the focal point for this CFO.

35. Pusteel has an agreement with VAI to ensure proper construction of the plant and its commissioning. The agreement determines specific roles and responsibilities as well as conditions and procedures in terms of construction and initial testing of equipment, commissioning, staff training, and the duration of VAI's stay on-site after commissioning. VAI will remain on-site as a technical advisor for the first year, and stay up to three years depending on the performance of the Phase I COREX plant in order to ensure its smooth operation.

H. Safeguard Aspects

36. Among the Bank's Safeguards Policies, only OP/BP 4.01 (Environmental Assessment) is triggered. See Annex 3 for more details.

37. The CFO will result in significant benefits of energy recovery and subsequent reductions of GHG emissions. Negative environmental impacts are expected to be insignificant, site-specific, and mitigated with readily-available measures. Therefore, this project is designated as Category B. Pusteel prepared a comprehensive EIA Report for the Plant Relocation Plan in which the CFO is fully covered. The EIA Report was found to be in line with national regulations and the Bank's safeguards policy requirements for a Category B project. Since an Environmental Management Plan (EMP) contained in the EIA Report covered the whole Plant Relocation Plan, a separate EMP for the CFO was formulated by extracting COREX-relevant elements from the EIA Report. The separate EMP will be referred in the ERPA and its implementation will be monitored.

38. Two rounds of public consultation were carried out in September-October 2004 and in March 2005 through on-line information disclosure and surveys followed by public meetings and individual interviews. A total of 19,523 web visits (113 valid questionnaire responses) were

recorded and 46 project-affected persons (PAPs) were consulted through the public meetings and individual interviews. The main concerns of the public were the feasibility of stated emission reductions, adoption of cleaner technologies, dust pollution, and resettlement issues. These concerns were dealt with by employing the cleaner COREX technology and pollutant control facilities and equipment. The EIA Report was disclosed locally on July 12, 2007, and in the Bank's Infoshop on September 18, 2007.

39. Land acquisition and resettlement for both Phase I and II was implemented in November 2004 prior to the involvement of the Bank with the CFO. Therefore, the CFO does not trigger the Involuntary Resettlement Policy.

40. It was confirmed with the Baoshan District Government that there are no ethnic minority people present in, or having collective attachment to, the project area. The CFO therefore does not trigger the Indigenous Peoples Policy.

I. Legacy and Reputational Risks

41. A total of 373.32 ha (including 87.71 ha of state-owned land) was acquired and 1,011 households (2,909 people) in Luojing town and Yuepu town in Baoshan district were affected by the Plant Relocation Plan. While it is not required by the Bank's Safeguards policies, Pusteel carried out a Post-Evaluation of Resettlement (PER) for due diligence from May to July 2007 and from March to April, 2008 to (a) review retroactively the process of the resettlement activities to verify whether it complied with Chinese laws and regulations; and (b) assess the impacts on the livelihoods of the affected households after resettlement. The PER concluded that the resettlement practices were in line with the applicable Chinese laws and regulations, and that the land acquisition had little impact on household income since most people earned their living from the service sector (91.88 percent in 2004) rather than the agricultural sector. All affected families had been resettled and livelihoods were improved, and by the time the PER was being conducted no outstanding issues remained.

42. The environmental performance of Pusteel and the EIA for the Plant Relocation Plan were also reviewed for due diligence. The results verified that the Plant Relocation Plan met all the national and local environmental, safety, and industrial hygiene requirements. It also confirmed, in accordance with a study conducted by the World Expo Committee, that no soil or groundwater contamination was found at the previous site. Therefore, no legacy or reputational risk associated with this CFO was identified.

J. Expected Main ERPA Terms and Conditions

43. The Bank will purchase CERs resulting from the CFO on behalf of the SCF from the project sponsor. The estimated amount of CERs to be purchased will be negotiated between the project sponsor and the Bank based on the calculations in the PDD and included in the ERPA. The exact CERs eligible for purchase will be determined by periodic verification after project registration. The payments will be made periodically subject to verification by an independent DOE accredited by the CDM EB.

44. A seven year crediting period will be chosen for the CFO, which is expected to be renewed twice up to 21 years in total. The Phase I COREX plant is expected to produce the

emission of 3,757,639 tCO_2e annually while the baseline scenario would produce the emission of 4,417,739 tCO_2e annually. Therefore, the estimated amount of annual emission reduction achieved by the Phase I COREX plant will be 660,100 tCO_2e. This emission reduction amount will double when the Phase II COREX plant becomes operational in 2010 (see Table 2). At present, the SCF intends to purchase three million tCO_2e of these emission reductions.

Table 2: Estimated Amount of Emission Reductions

Year	Project activity Emission (tCO_2e)	Baseline emission (tCO_2 e)	Leakage (tCO_2e)	Emission reductions (tCO_2 e)
2008	3,757,639	4,417,739	0	**660,100**
2009	3,757,639	4,417,739	0	**660,100**
2010	3,757,639	4,417,739	0	**660,100**
2011	7,515,278	8,835,478	0	**1,320,200**
2012	7,515,278	8,835,478	0	**1,320,200**
2013	7,515,278	8,835,478	0	**1,320,200**
2014	7,515,278	8,835,478	0	**1,320,200**
Total	41,334,029	48,595,129	0	**7,261,100**

Annex 1: Detailed Description of the COREX Technology

1. The schematic diagram of the COREX process is shown in Figure A1-1, and technical advantages of COREX in comparison with BF are summarized in Table A1-1.

Table A1-1: Technical Advantages of COREX

Item	Technical Advantages in comparison with BF
Quality of molten iron	**Same quality**
Calorific value of by-product gas	**About 7,850 kJ/m^3 - significantly higher than BF gas (about 3,300 kJ/m^3) and therefore more usable for power generation and heating**
Coal quality requirements	**Compatible with a wide range of coals including conventional non-coking coal while having specific requirements on feed-in coke in terms of size, shape, and density**
Energy saving (CO_2 reduction)	**15 percent reduction in terms of CO_2**
Pollutants emission	**Significantly lower than the BF process by avoiding the sintering and coking processes (e.g., more than 90 percent reduction in terms of SO_2, NOx, and dust)**

2. The COREX process is an iron-making process that uses non-coking coal as the reducing agent for smelting reduction. Lump ore, limestone, and dolomite are transported to an ore storage tank with belt conveyers, then loaded into a reduction shaft furnace. Dried coal is loaded into a gasifier *via* a coal chute and pressurized coal tank. Cooled high-temperature reducing gas from the gasifier is introduced into the shaft furnace and passes through ore layers upwards by which ferric oxides are reduced to sponge iron. The sponge iron is fed continuously to the gasifier with screw dischargers. By-product export gas is transported to a CCPP for power generation after wet de-dusting.

3. The gasifier is used for melting sponge iron to produce high-quality molten iron, while it also produces reducing gas to be used in the shaft furnace. The coal charged from the top of the gasifier is dried and degassed in the upper area of the char bed. The degassed coal (char) is gasified by oxygen blown in through the tuyeres, where a char bed is formed and the high-temperature reducing gas is produced. The reducing gas is de-dusted with a hot cyclone dust collector and provided to the shaft furnace, while the dust collected at the hot cyclone dust collector is returned to the gasifier as a material. The sponge iron charged into the gasifier is molten and forms molten iron while descending in the gasifier where impurities in the iron ore and coal are separated from molten iron to form slag.

4. Coal and material loading facilities for a COREX plant include: (a) coal drying system to dry nut coal; (b) coal loading system to receive lump coal from stock yard and coal dry system, and load the lump coal into a pressurized coal tank; (c) material loading system to load lump ore, pellet, limestone, and dolomite to an ore storage tank; (d) top charging system to charge coal and materials into the gasifier and reduction shaft. Other ancillary facilities include casthouses, pig casting machines, and fine coal cold-briquetting equipment. For each of the facilities, dust

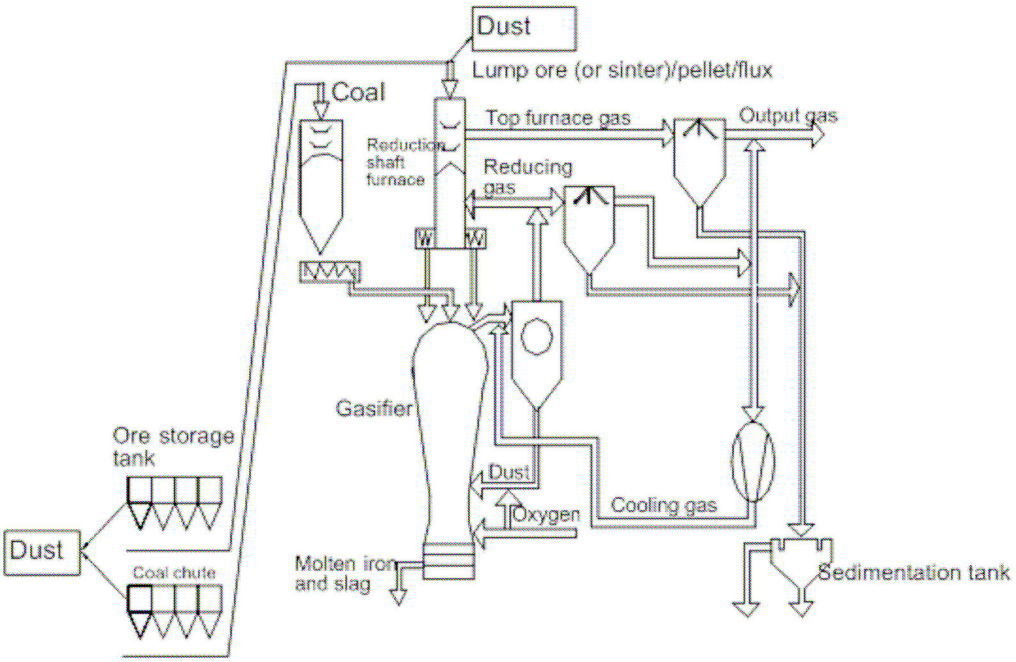
removal facilities (such as bag filter, precipitator, scrubber, and cyclone) are equipped to achieve the designed dust level of 35 mg/Nm^3.

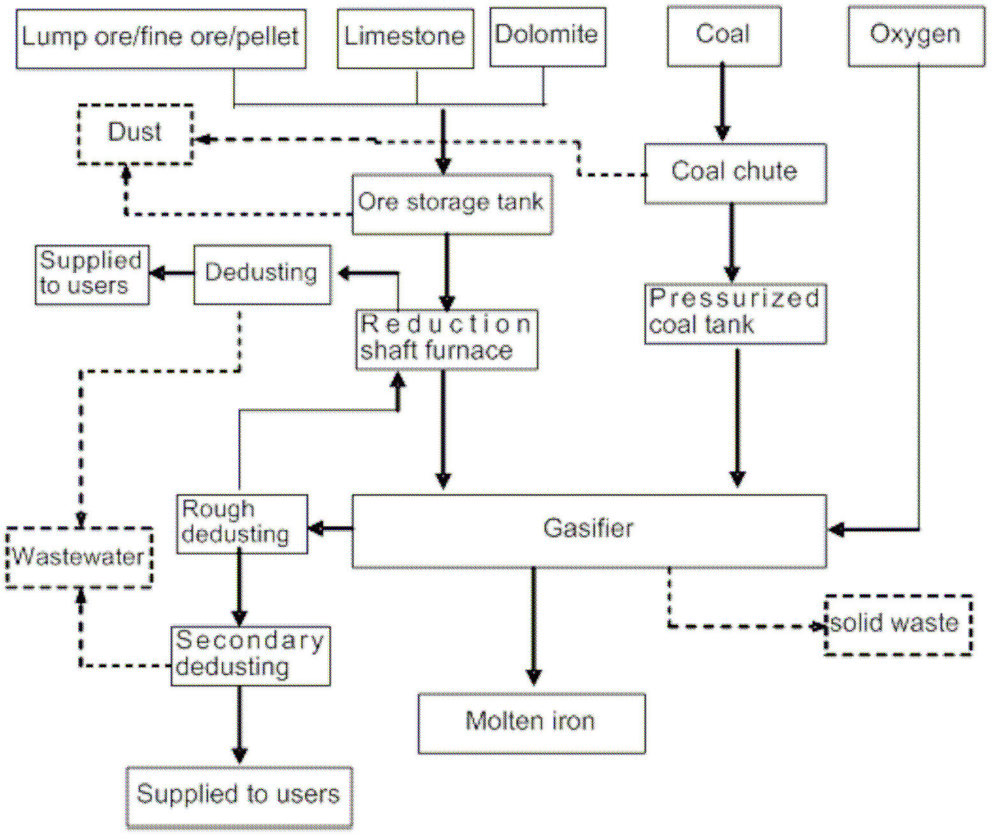
5. Two sets of 60,000 Nm^3/h oxygen generators for each COREX plant supply oxygen used for the COREX process. The oxygen generator comprises an air filtering and compression system, an air pre-cooling system, an air separation distillation system, an air compressing system, and a storage system.

6. In the CCPP, gas and air are compressed to 1.5-2.2 MPa and combusted in a combustion chamber. The flue gas at high temperature drives a combustion turbine then an air compressor and generator to generate electricity. The flue gas emitted from the combustion turbine at a temperature of above 500 °C is used to generate steam in a heat recovery steam generator which is used for power generation with a steam turbine.

7. The test operation of the COREX plant began in the fall of 2007. The first tap of hot metal from the COREX process was produced in November 2007. The total hot metal production for November was 27,514 tons and the daily gas output was 2.75 million m^3. The quality of hot metal in November 2007 was unstable, mainly because of lower melting efficiency and a pause of oxygen blowing. The monthly hot metal output and daily gas output for December 2007 increased to 85,400 tons and 4.875 million m^3, respectively. The operation ratio of COREX plant in December was 90.53 percent. The monthly hot metal output for January and February 2008 was 82,621 tons and 87,492 tons, respectively. These data show robust and successful initial test operations.

Figure A1-1: Schematic Diagram of COREX Process



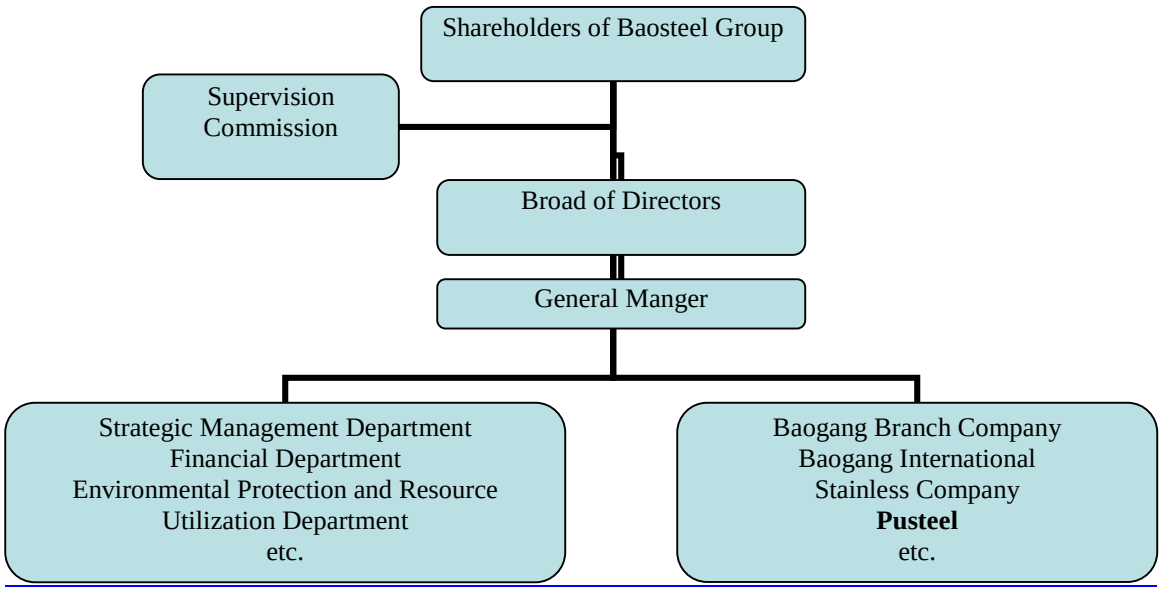


Annex 2: Financial and Cost Analysis

1. The project proponent, Pusteel is one of 22 wholly-owned subsidiaries of Baosteel (see Figure A2-1). In early 2005, in preparation for the 2010 World Exposition, Pusteel began to phase out operations at its original worksite in Pudong. For example, the company closed its stainless steel production facilities in 2006. At the end of 2006, Pusteel also sold one of its two existing plate mills from its old works in Pudong to eastern China's Jiangyin Changda Steel, and moved the other to Baosteel's Bayi subsidiary in China's Xinjiang Uyghur Autonomous Region in July 2007. By the fall of 2007, the only remaining operations at the original site were concentrated within its 1.5 million tons per year heavy plate mill for ship-building. The company closed this last remaining mill before the end of 2007. The company has started test operations at its new plant in northern Shanghai and will focus on the production of heavy plate while giving up production of all other products, including stainless steel, under the mandate of its owner Baosteel.

2. Financial due diligence for this CFO focused on the parent company, Baosteel rather than Pusteel since the relocation of Pusteel and the decision to invest in COREX technology were all made at the corporate level; therefore it is Baosteel that is assuming responsibility for the success of the new plant.

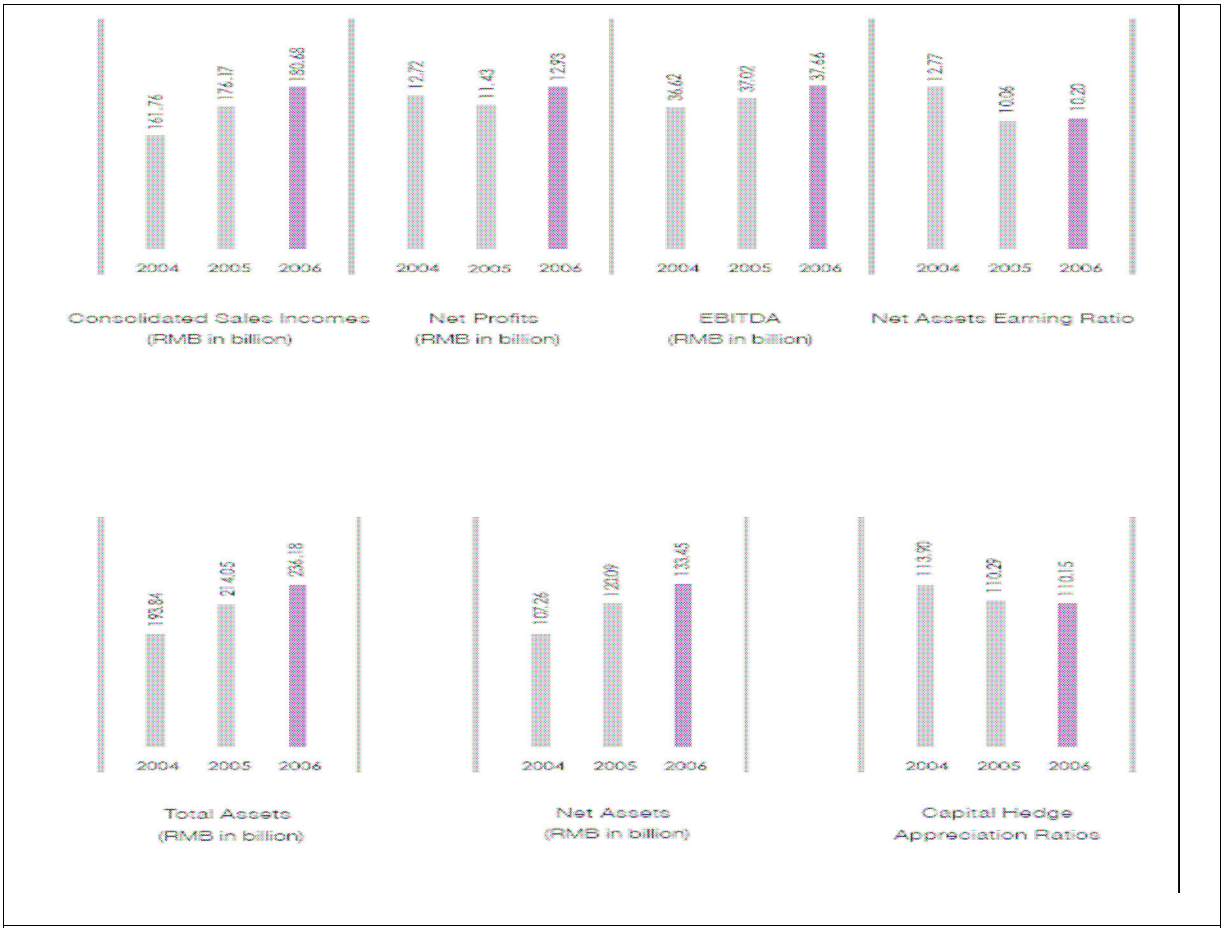
Figure A2-1: Organizational Structure of Baosteel



3. The operation of Baosteel is expected to be sustainable as China's economy and steel output have been increasing at near-record paces. While Baosteel's overall profitability in 2005 declined from 2004 due to increasing costs and competitive pressures, continued growing demand for high-quality steel products, as well as infrastructure and efficiency up-grades, improved the long-term prospects for the company and net profits increased 13 percent in 2006 (see Table A2-2). Baosteel's operating cash flow, together with cash reserves and moderate debt, are expected to be sufficient to fund its capital development programs. Baosteel's capital

structure is strong. Net debt-to-capital peaked at about 15 percent in 2004, before tapering off as cash flow improved with the commencement of new operations and a reduction in capital expenditures. This was also reflected in the company's credit rating up-grade by Standard and Poor's from BBB+ to A-.

Figure A2-2: Financial Performance of Baosteel



Source: Baosteel Annual Report 2006

Annex 3: Safeguard Policy Issues

ENVIRONMENT

A. Applied Policies and EA Preparation

1. This CFO is part of the Plant Relocation Plan and will result in significant benefits for energy recovery and emission reductions of GHGs and air pollutants. Negative environmental impacts are expected to be insignificant, site-specific, and mitigated with readily available measures. Therefore, the CFO is designated as a Category B project. The project boundary for safeguards compliance is limited to the COREX processes and CCPPs including: (a) coal and ore preparation and feeding system; (b) reduction shaft furnace; (c) gasifier; (d) dust collection system; (e) oxygen stations; and (f) CCPPs.

2. Pusteel prepared a comprehensive EIA Report for the Plant Relocation Plan in which this project is fully covered. The EIA Report was approved by SEPA in March 2005. The task team reviewed the EIA Report and found it in line with national regulations and safeguards policy requirements for a Category B project. Since an EMP contained in the EIA Report covered the whole Plant Relocation Plan, a separate EMP for the CFO has been formulated by extracting COREX-relevant elements from the EIA Report. The separate EMP will be referred in the ERPA and its implementation will be monitored.

3. Within the project boundary, the main environmental issue is dust emissions from coal and ore preparation and feeding processes, the reduction shaft furnace and gasifier, and molten iron discharge processes, where dust is collected and treated with proven dust removal equipment such as bag-filter, precipitator, scrubber, and cyclone. The comparison between the Chinese standards and Bank Environmental, Health, and Safety Guidelines (EHSG) were made in terms of major environmental issues such as air pollutants and noise, and shown in Table A3-1. This CFO employs equivalent with or stricter than Chinese standards and EHSG. Almost all of the wastewater and solid wastes from the COREX process are re-used so that the same comparison was not made.

Table A3-1: Comparison of Chinese Standards and EHSG

Emission Standard	China*	EHSG**	Design values for the project	Actual value at test operation
Air Emission				
Particulate matter (mg/Nm^3)	120	50/50	35	20
SO_2 (mg/Nm^3)	100	500/2000	65	Not available
NOx (mg/Nm^3)	240	500/125	80	Not available
Noise (day/night)				
Residential/Educational area (dB)	55/45	55/45	55/45	Not available
Industrial area (dB)	65/55	70/70	65/55	Not available

* Integrated Emission Standards of Air Pollutant (GB16297-1996), Emission Standards of Air Pollutants for Boiler (GB13271-2001) and Standard of Environmental Noise of Urban Area (GB3096-93).

** Since COREX is a new technology which does not include traditional sintering and coking processes, there are no COREX-specific air emission standards in the EHSG. The Air Emission Levels of Integrated Steel Mills/Thermal Power (gas turbine) are quoted.

B. Baseline Environment

4. The new plant site of Pusteel is located in Luojing town, Baoshan District of Shanghai, with a total area of 3.2 km^2. Baoshan District is an important industrial zone in Shanghai and the project site is in the Luojing port area is about 700 m south of the Yangtze River. Environmentally sensitive sites identified in the EIA Report include: Chenhang Town (1,300 m northwest), Shengqiao Town (2,300 m southeast), Chenhang Reservoir (1,500 m upstream, northwest), a nearby canal network, and the Yangtze River.

5. Baseline environmental monitoring of ambient air indicated compliance with applicable ambient air quality standards in terms of SO_2, NO_2, and fluoride, while TSP and PM_{10} often exceeded the standards due to dry winter weather, bare roads, industrial activities, and massive infrastructure projects in the area. Monitoring results for the Yangtze River showed compliance with applicable standards except for COD and NH_4^+-N. Baseline monitoring was also conducted for ambient noise, groundwater, and soil of the project site, and all were found in compliance with relevant applicable standards.

C. Environmental Issues related to the Project and Mitigation Measures

6. *COREX*. Dust is generated from coal preparation, coal and material feeding, casting, and gas transportation processes. Bag filters, hot cyclones, wet scrubber, and other high-efficiency (99 percent removal rate) dust removal equipment are employed to collect dust and achieve the design value of 35 mg/Nm^3. A measurement during the test operation showed the actual dust emission value of 20 mg/Nm^3, which was lower than the design value. Wastewater generated from the cooling, gas scrubbing, and slag treatment processes will be treated at an independent wastewater treatment facility and recycled (more than 98 percent recycling ratio with a 2 percent of make-up water) without discharge into the environment. Solid wastes such as slag, dust collected by the dust removal facilities, sludge generated at the wastewater treatment facility, and waste refractory material will be generated. However, the slag (1 million tons per year when both phases are operational) and waste refractory material will be primarily used for building and construction materials subject to the confirmation of no hazardous wastes being involved, and others will be re-used as raw materials at other steel mills.

7. *CCPP*. Combustion gas from CCPPs contains SO_2 and NOx, which will be treated with a gas washing system and discharged *via* 60m-height stacks. The emission concentrations of SO_2 and NOx are less than design values of 65 mg/Nm^3 and 80 mg/Nm^3, respectively. Small amounts of wastewater generated from the gas washing system will be re-used for slag treatment, and 2.0 m^3/h of wastewater per each CCPP unit generated from boilers will be re-used for slag treatment or sent to the company's central wastewater treatment plant. Noise insulation cover will be provided for gas turbines and generators, and a silencer will be installed for the steam discharge outlet and pressure release facility. No waste is generated from CCPPs.

8. *Oxygen station*. Cooling water is mostly re-used but very little amount could be sent to the company's central wastewater treatment plant. Noise will be minimized by proper design and installation. No waste is generated from the oxygen station.

9. Overall, the main environmental issue is dust emissions, with SO_2 and NOx to a lesser extent, which will be adequately addressed with commonly used mature dust removal technologies to ensure compliance with relevant standards. Transportation of raw materials and finished products is primarily done by ship so that no major traffic-related impacts on residential and business areas are envisaged.

D. Environmental Management Plan

10. A separate EMP for this CFO was formulated by extracting COREX-relevant elements from the EIA Report, which specifies the environmental management organization setup in Pusteel with specific description of COREX-related department and staff responsibilities, training plan, pollutant emissions and environmental monitoring plan (see Table A3-2), and reporting mechanism. The Safety and Environmental Groups established under the Iron-making Department and Energy Department are responsible for the implementation of the EMP and supervision of contractors while the Department of Safety and Environment is responsible for the supervision of the implementation of the EMP and its improvement. The environmental monitoring will be conducted by an environmental monitoring company under the supervision of the Department of Safety and Environment. The monitoring data will be reported to, and analyzed by the Department of Safety and Environment, then submitted to the Bank annually. The separate EMP will be referred in the ERPA and its implementation will be monitored by the Bank.

Table A3-2: Summary of Emission and Environmental Monitoring Plan

Item	Monitoring points	Parameters	Frequency
Air emissions	Outlets of dust removal equipment	Dust	Once per quarter
	Outlet of CCPP stack	NOx and SO_2	
Wastewater	Inlet and outlet of the central wastewater treatment facility	pH, SS, COD, NH_4^+-N, CN^-, F, Fe, Mn, Ni, Oil, Total Cr, Cr^{6+}	Once per ten days
	Outlet of gas scrubbing water treatment equipment	pH, SS, COD, NH_4^+-N, CN^-, Oil	Twice per month
Ambient air	Site boundaries and center of the site	NOx, SO_2, TSP and falling dust	Once per half year
Noise at site boundary	Site boundaries	Leq (A)	Once per half year, day time and night time

E. Public Consultation and Information Disclosure

11. Two rounds of public consultation were carried out from September -October 2004 and in March 2005, through on-line information disclosure and survey followed by public meetings and individual interviews. A total of 19,523 website visits (113 valid questionnaire responses) was recorded and 46 potentially affected people were further consulted via public meetings and individual interviews in the first round. The second round consultation mainly targeted people who were not supportive of the project in the first round. The main concerns and requests from the public included effectiveness of stated pollution control measures, Pusteel's commitment to the adoption of cleaner production processes, and associated environmental deterioration. These

concerns were dealt with by employing the cleaner COREX technology and pollutants control facilities and equipment.

12. The EIA Report was disclosed in Luojing Township Government, Number1 Village Committee, Haihong Village and Chuansha Village committees on July 12, 2007, with announcements made using local bulletin boards. The EIA Report was also disclosed in the Bank's Infoshop on September 18, 2007.

F. Environmental Impact of Plant Relocation Plan

13. The whole EIA Report for the Plant Relocation Plan was reviewed as part of the due diligence exercise. The EIA Report addressed potential environmental impacts on air, surface water quality and ecology, ambient noise, risks of gas leakage/explosion, and oil spills. The report concluded that the Plant Relocation Plan was in compliance with national industrial sector policies and the Master Plan of Shanghai. All pollution emissions are expected to be in compliance with applicable national standards. Table A3-4 shows the amounts of key air emissions due to the Plant Relocation Plan and the contributions of the CFO.

Table A3-3: Air Emissions due to the CFO and Plant Relocation Plan

Air Pollutants	Phase I (ton/yr)		Total (ton/yr)	
	Project	Overall	Project	Overall
Dust	262.0 (31.1%)	841.7 (100%)	524.0 (34.7%)	1,509.3 (100%)
SO_2	443.1 (64.0%)	692.1 (100%)	873.7 (65.5%)	1,332.9 (100%)
NOx	704.2 (45.2%)	1,559.3 (100%)	1,391.8 (50.7%)	2,746.2 (100%)

14. The contribution of the CFO in terms of water pollutants could not be examined since plant wastewater is treated and discharged at the company's central wastewater treatment plant. However, it can be assumed that the contribution is minimal because most of the wastewater generated in the CFO will be separately treated and re-used.

15. Modeling results on ambient air quality and surface water quality impacts concluded that, upon the completion of the Plant Relocation Plan, ambient air quality at the environmentally-sensitive sites will meet applicable national ambient air quality standards in terms of SO_2, NO_2, and fluoride, while predicted PM_{10} concentrations at Shengqiao Town will be slightly higher than the standard due to a baseline pollution level already exceeding the standard. However, the additional contribution of the Plant Relocation Plan to the current PM_{10} concentration levels is predicted to be 5.4 percent. Wastewater discharged into the Yangtze River may contain SS, COD, petroleum oil, fluoride, and heavy metals, but it will meet applicable regulation standards and will have a negligible impact on water intake at the Chenhang Reservoir and river ecology. The nearby villages (more than 1.3 km away) will not be adversely impacted. The EIA also addressed the risk and safety issues, which included accident scenario analysis, mitigation measures, and emergency response plan. In terms of noise, the Plant Relocation Plan will have little impact on environmentally-sensitive sites because they are far from the project site.

16. The EIA includes proper mitigation measures for the construction and operation phases, as well as an EMP. It is fully in line with national regulations and was approved by SEPA in March 2005.

G. Environmental Due Diligence Review of Pusteel

17. While not included in the project boundary, the environmental performance of Pusteel was reviewed by the task team and an independent consultant for due diligence. This review comprised interviews with relevant site personnel, a review of available documentation, and a visual observation of the site. The key documents reviewed included the EIA Report, Safety Pre-Assessment Report, Industrial Hygiene Pre-Assessment Report, Soil and Groundwater Monitoring Report, Dismantling Plan for the Existing Plant, and other relevant technical documentation.

18. The review verified that the Plant Relocation Plan met all the national and local environmental, safety, and industrial hygiene requirements. Although some of the old facilities at the previous site had not met current environmental requirements, they have ceased operations and have been dismantled. It was also confirmed, in accordance with a study conducted by the World Expo Committee, that no soil and groundwater contamination was found at the previous site in Pudong. The Safety and Environmental Management Department of Pusteel has prepared a Safety and Environmental Preparation Plan for the start-up of the new plant. The relevant staff has received ISO 14001 and/or OHSAS Internal Auditor training in preparation for such accreditations. Recommendations made by the independent consultant were taken seriously and addressed by Pusteel. It was confirmed that an effective Environmental Discharge Permit issued by Shanghai City was in place for the plant. Therefore, no legacy or reputational risk associated with this CFO was identified.

SOCIAL

Post-Evaluation of Resettlement for Plant Relocation Plan

19. This CFO does not trigger OP 4.12 because resettlement activities were completed before the involvement of the Bank. However, a PER was conducted for due diligence to review retroactively the process of the resettlement (which took place in 2004) and assess the impacts on the livelihoods of the affected households after resettlement.

20. ***Methodology.*** Pusteel commissioned the National Research Centre for Resettlement (NRCR) to carry out the PER. The terms of reference for the PER was reviewed by the Bank before Pusteel and NRCR signed their contract. NRCR carried out a desk review of relevant project documents and local socio-economic data, conducted semi-structured interviews, and organized focus group meetings with affected households as well as Pusteel staff, government officials, and village heads who were involved in the resettlement activities. Furthermore, a sample of 56 households (about 5.5 percent of the total affected households) was selected from all seven affected villages for a detailed socio- economic survey. A draft PER report was submitted to the Bank in July, 2007 and the final version of the report was submitted to the Bank in April, 2008.

21. ***Resettlement related risks***. No resettlement-related reputational risk has been identified. The PER report concluded that: (a) the land acquisition process fully complied with Chinese laws and regulations, and (b) no outstanding issues remained by the time the PER was conducted, and (c) all affected families were resettled and their livelihoods improved.

22. ***Resettlement impacts***. The land acquired for the Plant Relocation Plan was 373.32 ha (including 87.71 ha of state-owned land) in total. The total number of PAPs was 2,909 from 1,011 households. In addition, 999 houses with the total floor area of 228,773.41 m^2 were demolished and all PAPs needed to be relocated. A total of 49 enterprises and institutions were also demolished.

23. ***Compensation***. A compensation policy applied to this project followed the common Chinese practice and was also in line with Shanghai's local regulations. Specially discounted replacement houses were arranged for PAPs, and all PAPs could purchase homes in towns.

24. ***Income rehabilitation.*** While all affected households were farmers, a significant proportion of their income came from the nonagricultural sector (91.88 percent in 2004) rather than the agricultural sector. Most of the relocated households settled in new homes in towns where service centers were closer than before, and they could more easily find new jobs. Therefore, the income of PAPs was little affected by the land acquisition. Income rehabilitation measures were also provided to all PAPs by the Baoshan District Labor and Social Security Bureau through social insurance schemes, which included job creation and training. Overall, the PER found that the land acquisition did not adversely affect the livelihoods of PAPs, and the income of PAPs increased after the land acquisition, even after factoring in inflation.

25. ***Consultation***. Public consultation was held during implementation to discuss compensation options and rehabilitation measures. Grievance redressing procedures were also provided.

26. ***Information Disclosure.*** The resettlement plan (covering compensation, rehabilitation and other assistance) approved by the Shanghai Municipal Government was publicly disclosed before the commencement of the resettlement.

27. ***Implementation***. All affected properties including land and houses were measured and registered before an agreement on resettlement and compensation was reached by the households and the implementing agencies. All compensation, rehabilitation, and other assistance provided in the resettlement plan were fully and promptly distributed to affected households. All of the displaced families resettled in new houses located nearby.

Annex 4: Project Preparation and Supervision

Table A4-1: Project preparation timeline

Stage of project preparation	*Planned*	*Actual*
PCM review		May 8, 2007
Appraisal		May 5, 2008
Approval to sign ERPA	June 20, 2008	
Negotiation	June 20, 2008	
ERPA signing	June 30, 2008	
Planned closing date	December 31, 2014	

Table A4-2: Bank Staff and Consultants Who Worked on the Project

Name	*Title*	*Unit*
Hiroshi Ono	Senior Environment Specialist/Task Team Leader	EASRE
Nuyi Tao	Technical Specialist/Deal Manager	ENVCF
Xueman Wang	Senior Counsel	LEGCF
Leiping Wang	Senior Energy Specialist	EASTE
Peishen Wang	Environmental Specialist	EASRE
Jun Zeng	Social Development Specialist	EASSO
Monali Ranade	CDM Methodology Specialist	ENVCF
Zijun Li	Consultant	ENVCF
William Nicholas Bowden	Consultant	EASRE
Zhuo Cheng	Consultant	EASRE
Minhnguyet Khorami	Program Assistant	EASRE
Yan Wang	Program Assistant	EACCF

Annex 5: Documents in the Project File

Project Design Document for Pudong Steel COREX Project

Proposed New Baseline and Monitoring Methodologies for COREX

Due Diligence Review Report of Environmental Performance, August 2007

Shanghai Pudong Iron & Steel Co. Ltd. Baoshan Steel Group - Environmental Impact Report on Relocation Engineering, March 2005

Environmental Management Plan for COREX Project, April 2008

Post-Resettlement Evaluation of Resettlement for COREX Project, April 2008

MAP: IBRD 36067